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A DIVISION OF
FLIGHTEX FABRICS INC.
EVERETT, MASS.

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REPORT NO. 10-60-50G-111 MONTHLY PROGRESS REPORT

ENGINEERING PROGRAM FOR
THE PILOT PRODUCTION OF A
LIGHTWEIGHT ANTITANK WEAPON

FOR THE PERIOD

MONTH OF OCTOBER 1960

CONTRACT NO. RD-142

ORDNANCE PROJECT NO.

DEPT. OF ARMY PROJECT NO.

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13

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FLIGHTEX FABRICS, INC.

PROGRESS REPORT #6

ENGINEERING PROGRAM FOR THE PILOT PRODUCTION OF

A LIGHTWEIGHT ANTITANK ROCKET

OCTOBER 1960

CONTRACT NO. RD-142

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SECRETWORK ACCOMPLISHED DURING THE MONTH OF OCTOBER 1960SYSTEM EVALUATION PROGRAM

Pilot production started on 14 October, and 220 complete HEAT units were assembled and canned by 21 October. This shows that the expected rate of production can be met.

The first quality control test (Test Schedule A, Specification T-310) was conducted on 27 October. With the exception of problems encountered on drop tests, the system was found to be acceptable. A simple remedy to improve drop safety tests has meanwhile been found. However, instructions were received from the Contracting Officer to ship the first batch without incorporating these minor improvements.

Penetration appears to be within the performance as obtained during R&D tests last year. Accuracy was satisfactory with the exception of one cold round which hit the target too low to be within the 3 ft. square at 50 meters, which would be desirable. All other aspects of the system were satisfactory.

It is planned to check out the improvements which are contemplated in order to insure greater drop safety and, having done this, production will be resumed. The practice systems will be produced next in order to give our range section more time for pouring heads. This operation has been somewhat slower than anticipated due to the fact that the set-up at the J-2 Range is of an experimental nature and this is the largest quantity of heads which has ever been poured. It was therefore difficult to predict the time it would take to produce the heads.

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SECRETHEAT HEAD EVALUATION PROGRAM

Including the 220 heads used in the first batch, a total of 550 heads have been poured to date. As reported last month, some difficulties have been experienced in pouring. Initially, attempts were made to pour the head in one pour, but it was found that cavities developed underneath the booster, probably due to lack of control of the cooling rate of the funnel.

A technique of loading the head with a double pour was developed.

This method uses the following procedure. The charge is poured better than two-thirds of the way, then allowed to cool, and after cooling the top surface is scraped clean by means of a chisel. The second pour then tops off the head. This method produced acceptable densities and, as was later shown when x-rays were taken, heads loaded in this fashion showed no cavities, and interface was only barely visible on a small number of heads.

Heads obtained with the single pour showed cavities in too great a number of cases. The decision was therefore made to pour the head with the two-pour method. The heads with cavities measuring more than 3/8" square on the x-rays were reworked; i.e., the charge was dug out, all the cavities were removed, and the head was then topped off again, thus creating a two-pour head. The reworked heads were re-x-rayed along with the new batch of heads obtained by the two-pour method, and it was found that the x-rays of all heads were satisfactory.

The rate of production of the heads has been disappointingly slow, mainly because of the difficulties cited above. At a meeting on 28 October it was therefore decided to invite Mr. Cox to visit the J-2 Range and to give his

- 2 -

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comments on the pouring operation with particular emphasis on ways of increasing the rate of production.

A static test of various heads was conducted on 12 October (after the first x-rays had been taken). The following is a tabulation of this test:

<u>Round No.</u>	<u>X-ray Results</u>	<u>Penetration (Inches in Mild Steel)</u>
1	Cavity	13 1/2
2	"	7 1/2
3	Double pour. Good interface.	11 1/4
4	"	8 3/4
5	Double pour. Interface visible.	7
6	Double pour. Good interface.	13
7	Small cavities (Universal Match)	12 1/2
8	No cavities (Universal Match)	7 1/2
9	"	11

Due to the small number of heads tested, it is difficult to come to any very definite conclusion based on these results. However, the interfaces and cavities do not appear to affect the performance of the head. Stand-off used was 3 3/8", which is slightly less than the stand-off to be expected under dynamic conditions. It should be remembered that the double liner used in this head will produce variations in penetration from round to round of as much as 7". Static or dynamic testing of any one lot can

- 3 -

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therefore be used only as a rough indication of performance because the number of heads which would have to be tested to obtain a reliable statistical analysis would be far in excess of anything which the scope of the present contract allows. Penetrations of rounds fired during the quality control test are tabulated in the Appendix. It appears that head penetration is very close to penetration obtained during the R&D testing.

MOTOR EVALUATION PROGRAM

As a result of warning Harvey Aluminum Co. that the quality of the material is of vital importance, we were notified that they had rejected the remaining batch of heads and were remaking them all. Delivery was promised for mid-November. This presents a very serious problem from the point of view of delivery date, which should not pose any problem from any other point of view. With the exception of quality control test round #18, the motor performed properly on all rounds. The round number mentioned hit low, probably due to the marginal interior ballistics of this motor at cold temperature. It does not seem feasible at this point to do anything about this situation.

FUZE EVALUATION PROGRAM

All fuzes worked satisfactorily during the quality control test. However, it has to be pointed out that static train functioning and dynamic tests have shown that a certain percentage of detonators may not have enough output to detonate the booster. We do not know what the exact percentage may be except that it is likely to be under 1%.

- 4 -

SECRET

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Fuze components have not yet been completed for the full quantity required for the contract. However, it is expected the full quantity will be delivered before the middle of November. This will make it possible to phase in the production of the fuze in a manner which will not affect delivery date.

LAUNCHER EVALUATION PROGRAM

No particular problems with the launcher have shown up. Seven hundred more launchers will have to be assembled as soon as components are available for this, which should be toward the middle part of November. Trigger pulls were satisfactory on all rounds fired during the quality control test.

DROP SAFETY

When performing the 40 ft. drop test (No. A-5), the round was not fail safe, but the motor was initiated. The fuze was safe, since the round hit the ground well within the arming distance of the fuze. This test was repeated with another system with the same result. Components of the two systems dropped, as well as components of a dummy system which was immediately dropped for checkout purposes, revealed the fact that the change in the end cap of the igniter assembly was responsible for this situation. The present end cap replaces the hex cap used during the R&D lot. This hex cap extends all the way to the cross piece. It served the purpose of positioning the cross piece as well as providing the anchor for the firing pin spring. The new design uses a Tru-Arc ring for positioning the cross piece,

- 5 -

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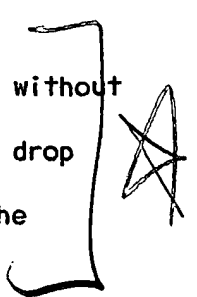
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and the end cap is held in place by means of three roll pins. The 40 ft. drop test showed that the Tru-Arc ring was sheared out of its groove, causing the pivot pin of the actuating lever to shear a slot in the cross piece, thus allowing the actuating lever to pivot around the safety pin hole. Compression of the firing spring was obtained in this manner, and, since the three roll pins will not strip as readily as did the thread of the hex cap, the spring will be compressed and when the parts finally break loose due to the impact of 40 ft. drop, the firing pin may be released into the primer. It is planned to put a sleeve between the cross piece and the end cap in order to make it impossible for the firing spring to be compressed. Drop tests with this assembly will be carried out, and the arrangement will be incorporated in the system with any other improvements that may be needed.

It is felt that due to the fact that this system employs an in-line firing pin and the firing mechanism is directly in the throat of the motor, it will never be 100% drop safe. Suitable cushioning material will at all times be required on drops of this nature, and it is suggested that when air dropping some of the honeycomb material be placed on the sides as well as the bottom of the package to provide cushioning in case of impacts on the nose due to fouled parachutes or due to hitting obstacles sideways.

The project officer informed us that we should ship the first batch without incorporating the sleeve and without waiting for the results of the drop tests. The systems will be marked with a red dot on both ends of the carton.

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SECRETQUALITY CONTROL TEST

A tabulation of this test is enclosed in this report. The results were satisfactory with the following exceptions:

1) 40 Foot Drop

When dropping a packaged system 40 feet on the nose (as called for in the Test Schedule A), the primer in the igniter was initiated by the firing pin of the igniter assembly. This deficiency is discussed in the Launcher Evaluation Program section of this report. More work is being done on this subject, and it is felt that the drop safety can be improved without materially affecting the cost of the delivery date of the program.

2) 3 Foot Drop

Both nose drop rounds were fail safe. The tail drop was operable, and one of the systems which had been dropped on the trigger was not operable but safe. It should be noted that a kink developed in the trigger linkage due to the system hitting a steel block on the base of the drop tower. The other system tested did not hit the edge of this block, thus avoiding the damage incurred by Round No. 6. (It was decided to change the specifications and to call for "operable or fail safe" under Test A-4 (3 foot free drop without package).)

3) Round No. 18 hit lower than permissible. This has been discussed in the Motor Evaluation Program section of this report.

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SECRETACCURACY INFORMATION

As will be noted when studying the test data sheet, a notation of the aim and hit coordinates for each round fired is given. This refers to the aiming set-up, which consists of the following:

An aiming template is used which is graduated both horizontally and vertically in 3" increments. This template is placed in front of the stack at which the rounds are fired in an offset fashion, which allows for the difference in aiming between 30 feet (at which distance the tests are conducted) and 50 meters (the aiming distance at which the lower sighting hole in the rear sight is calibrated). Each system is then sighted in by its own sight, and the aiming coordinate is noted. A second template, which is transparent and equipped with a corresponding grid, is then placed on top of the stack to record the hit. Coordinates are read by starting with the horizontal.

Thus Round No. 13, for example, will be interpreted in the following way:

- 1) Aimed at template 9" horiz., 15" vert.
- 2) Using the same reference planes, the transparent template shows the hit as: 6" horiz., 12½" vert.

- 3) Knowing that ^{1 ft AT 50 FEET} ~~6" at 30m~~ corresponds to 3¼ ft. at 50m ~~and allowing a~~ ^{6"} ~~3 ft. square~~, the hit must then be recorded within ^{CP} in any one direction of each coordinate. *THIS ALLOWS FOR A 3¼ ft. SQUARE AT 50M WHICH IS SLIGHTLY SMALLER THAN CALLED FOR ON SPEC T 310.**
- When evaluating in this manner, it is found that most rounds were well within specification.

- 8 -

* RE ABOVE - NOVEMBER REPORT - TASK III - 7 (OG 430 C - 1 DE - 244)

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SECRETFUTURE PROGRAM

At a meeting with the Project Officer on 28 October, it was decided to proceed in the following manner:

- 1) Check out the additional sleeve to be placed around the igniter as regards drop safety and incorporate this and any other minor changes which transpire in the course of this work.
- 2) Proceed with the program and do everything possible to have the first batch of 200 ready at the earliest opportunity.
- 3) Assemble the practice systems next and notify the Contracting Authority as to the expected date of the check-out test for this. This will give the inspector time to make arrangements for attending the test.
- 4) Fire the 50 accuracy rounds in the presence of the Project Officer in order to obtain data on safety for shoulder firing.
- 5) Consult with Mr. W. Cox on the subject of expediting the loading of the heads.
- 6) Finish up the program by producing the remaining batches of HEAT systems.

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~~SECRET~~APPENDIXBATCH NO. 1QUALITY CONTROL
TEST10/27/60

<u>Round No.</u>	<u>Test</u> <u>(Per T-310)</u>	<u>Accuracy</u>	<u>Penetration</u>	<u>Trigger</u> <u>Pull</u>	<u>Comments</u>
1	A-1 Vibration	Aim 6-9 Hit 4-8	6¼"	18	OK
2	A-2 Jolt				System oper- able and safe
3	" "				"
4	A-3 Jumble				Fail safe OK. Not operable.
5	" "				"
6	A-4 3 Ft. Drop on Trigger				Trigger link- age bent. Not operable but safe.
7	" "	Aim 18-15 Hit 19-12½	7½"	17	OK
8	A-4 Nose				Fail safe.
9	" "				" "
10	A-4 Tail	Aim 15-15 Hit 14-16	8 3/4"	17 3/4	
11	A-5, 40 Ft. Drop				Unsafe initi- ated motor. Fuze safe.
12	A-6 Humidity	Aim 6-15 Hit 1-14½	6¼"*	17	Hit edge of plate.
13	" "	Aim 9-15 Hit 6-12½	6¼"	17	OK

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- 2 -

<u>Round No.</u>	<u>Test</u> (Per T-310)	<u>Accuracy</u>	<u>Penetration</u>	<u>Trigger</u> <u>Pull</u>	<u>Comments</u>
14	A-7 Water	Aim 12-15 Hit 11½-13	10"	17	OK
15	A-8 Hot +120°	Aim 12-21 Hit 13-19½	7½"	16	OK
16	" " "	Aim 15-21 Hit 17-24½	6¼"	17	OK
17	" " "	Aim 18-21 Hit 17½-20	10"	17	OK
18	" Cold -30°	Aim 6-21 Hit 5-6	5"	16	OK
19	" " "	Aim 6-21 Hit 4½-19	5"	18	OK
20	" " "	Aim 9-21 Hit 9½-18	6¼"	19	OK

*Not considering Round No. 12, the average penetration from the above shots comes to 7.15".

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